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THE EDUCATIONAL AIMS AND PRACTICES OF THE CALIFORNIA INSTITUTE OF TECHNOLOGY

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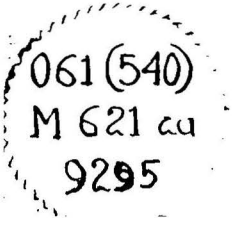

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THE EDUCATIONAL AIMS AND PRACTICES OF THE CALIFORNIA INSTITUTE OF TECHNOLOGY

Within the past forty-years thirty-one of our forty-eight American States have passed laws requiring every youth to remain in the secondary school up to the age of from 16 to 18. As a result to-day more than 66 per cent of all young Americans actually attend school up to that age. The fundamental reason for this lies in the improved economic position of the worker which alone has made this possible.

In view of this situation it has seemed to the Trustees and Faculty of the California Institute of Technology that the first, and perhaps the most important task of the *higher* educational system, which begins at the end of the secondary school period, or at what we call the twelfth grade (age 16 to 18), is to see to it that there is at that time a very careful *selection*, on the basis of demonstrated interest, aptitude and ability, of that eighth or tenth of the American youth who have shown in the secondary school period the greatest promise of success and effectiveness in leading the higher life of the nation in the essentially intellectual and analytical pursuits. Broadly speaking these constitute the professions such as the law, medicine, education, government, management, engineering, writing, scientific research, finance, etc.

The higher educational system of the country should clearly exist primarily for the thorough training of this best eighth or tenth of the population, since nothing is more cruel to the individual or more disastrous to the state, than to attempt to train youths either for jobs which do not exist, or for pursuits in which the individual in question has not the capacity to succeed. Obviously only a small fraction of the population of any country can possibly be absorbed professionally into the higher intellectual life and

responsibilities of the nation ; and just as obviously too the average citizen has neither the capacity nor the desire to endure the headaches which these responsibilities entail. No one is more pathetic or miserable than the man who gets into a job in which he finds that he has neither the capacity nor the training to succeed.

Having come to the conviction that the so-called Universities of the United States are not yet doing either this *selecting* job, or the subsequent training job, as thoroughly as is desirable, the California Institute of Technology, from the inception of its organization in its present form, decided to admit by examination only, and to restrict to 160 the number of young men admitted each year from the secondary school to its freshman class. This gives it a maximum possible enrolment for its four undergraduate years of 640 men. It actually has to-day an undergraduate attendance of 617 men and a graduate attendance of about 300 men, nearly all of this latter group being at research of some kind. There are no women at the Institute.

Further, since its avowed aim from the start has been to train as thoroughly as possible primarily scientists and engineers capable of handling the increasing complexities of our modern scientific civilization, and since example is always and everywhere a more potent teacher than is precept, the Institute has made every possible effort to see to it that its permanent staff of about a hundred is as far as possible composed of men who are themselves productive men, each in his chosen field ; for a great university has always, from the time of Plato down, been best described simply as a group of masters and their pupils or apprentices. It is for this reason, too, that the California Institute has adopted a form of administration which is unique among American institutions. It has no President and subordinates administration to professional effectiveness. In place of a President it has an "Executive Council" consisting of four members of the Board of Trustees and five members of the Faculty. This body meets frequently and exercises the usual powers exercised by the President, and it assumes also interim powers for the board of

Trustees. This latter body is a self-perpetuating group of 19 men upon whom the final responsibility for the institution rests. They all serve as a public responsibility and without compensation. They usually meet about four times a year. They appoint the Executive Council and designate its Chairman. Since the Executive Council contains four of the most active and influential Trustees no case has ever occurred in which that Board has reversed an action of the Executive Council, though the most important matters are always brought before the full Board before a decision is reached.

An organization similar to that of the Executive Council is for the most part used in the departments. The highest administrative rank to which a member of the staff can attain is membership in the Executive Council. The highest academic rank is that of full professor in the California Institute. There are in all about thirty-five of these full professors, six in Physics alone, all of co-ordinate rank, working co-operatively and wholly without friction. The highest salary paid in the Institute is received by a professor who has practically no administrative responsibilities, and in general the more highly paid members of the staff are the productive scientists and engineers rather than the administrators, though a certain number of the members of the staff possess an excellent combination of both qualities.

Since the Institute is trying to train scientists and engineers who will be influential in the life and development of the nation it requires all of its undergraduate students to spend one-fourth of the time involved in its four year undergraduate course in gaining familiarity with the world's best thought in literature, economics, government, history, philosophy, and ethics—in a word with world history in the broad sense of that term. This is another unique feature of its educational policies.

In its graduate school, which is recruited partly from say the best fifth of its own graduating classes, but largely also from other institutions and from abroad, the Institute carries on a large programme of research both pure and applied, and this research is in

general centered around the large group of specific problems or projects which it is all the time undertaking. It takes on a new one whenever it feels itself in a peculiarly favourable position to attack a problem that is crying for solution either because it serves the local interests of the Southern California community, or the broader interests of the national or world community. It aims at the intensive pursuit of the problems or subjects which it feels itself for one reason or another exceptionally well fitted to attack, but it never introduces courses because they are a conventional part of a university curriculum. This is why it does not call itself a University. For example, it has no Faculty of Law, or Medicine or Architecture, or Mining Engineering for the reason that its analysis of these fields convinces it that it is not in the general interest to add to the already adequate supply of candidates for a place in these professions. Indeed some of them are already oversupplied with competent and adequately trained men.

In spite of the fact that the Institute does not call itself a University, the so-called Association of American Universities, consisting of about thirty of the most outstanding institutions of higher learning of the country some years ago invited the California Institute of Technology and the Massachusetts Institute of Technology into its membership on the ground that the proper definition of a University is to be found in the *quality* and *grade* of the work it does in its chosen field, rather than in the *range* of the fields which it attempts to cover. This is how it happens that though the California Institute of Technology does not officially call itself a University it has been elected to serve this year as the President Institution of the Association of American Universities.

The higher degees which the Institute now confers are the M. S. and the Ph. D. in the following fields :—Aeronautics, Mechanical, Civil, Electrical, Chemical, Hydraulic Engineering, Mathematics, Physics, Astrophysics, Chemistry, Geology, Seismology, Meteorology and Biology, the last of these including Genetics, Physiology (both animal and plant) and Biochemistry.

The Institute's graduate and research work is largely centered around the special problems which it is attacking. A few of these may be mentioned, merely as illustrations, as follows :—

The largest present project is the building of the 200-inch telescope to be set up on Palomar Mountain. This project came to it and the Mount Wilson Observatory, which is close by and co-operates with it intimately in this and other undertakings, first because of the climate, the "astronomical seeing hours" being very much greater in Southern California than elsewhere, and second because there was already present in Pasadena the highly skilled and experienced personnel which was essential to the successful carrying through of so huge and difficult an engineering as well as an astronomical undertaking.

Another of its very large projects is the seismological one demanded of it both because Southern California is one of the best places in the world for the study of earthquakes, and second because its huge oil industry is demanding increasingly the latest seismological knowledge and the most improved seismological techniques. Indeed we are located in what is probably the most favoured locality in the world for the study of geology in all its phases.

But the utilization of the results of geological and seismological advances carry with them, especially in a semi-arid climate like ours, the pressing need for the highest possible skill in civil engineering to properly locate and build earthquake-proof dams, schools and other structures, and this again carries with it the need for hydraulic and electrical engineering competence of a very high order. The staff of the Institute has therefore been engaged upon hydraulic research projects for transmitting water as economically as possible from Hoover Dam, two hundred and fifty miles away and over 1700 feet elevations to Southern California, and electrical engineering problems on the most economical transmission of electrical energy over similar distances from our high mountain lakes. The Institute too has taken on important meteorological problems, for rain and frost forecasting are of enormous significance to a horticultural region like

ours. These projects have required us to devise radio methods for bringing us daily information about upper air conditions from balloons carrying up very light transmitting equipment, and we are now using this equipment for our cosmic ray researches. All these astrophysical, geological and engineering undertakings have required the development of staffs in Physics, Chemistry and Mathematics of a really effective and competent kind.

Another of the Institute's latest and most significant projects has involved the introduction of a section on labour relations into the department of economics. This is one of the world's most critically important problems. Our young engineers practically all go out into industry, and statistics show that the key men in industry come chiefly from schools of our type. We are therefore requiring every young man who goes through the Institute to take a course in labour relations before he gets into his industrial works. But more than that, industrialists suspect the data put out by labour unions and the labour unions suspect the facts presented by industrialists, but both groups have enough confidence in the Institute's objectiveness and scientific mode of approach to be willing jointly to provide the funds necessary for setting up a source at the Institute of factual information for the use of both industrialists and labour groups, and we hope that the record we shall make will merit the confidence they have shown in us. This project, like most of those the Institute undertakes, is supported by the requisite contributions from those who reap the benefit of our studies and are desirous of having us continue to make them.

The Institute has no support from government whatever. About one-third of our budget comes from tuitions and the remainder from the income from endowment and from special gifts for special projects. We are kept continually on our toes to do sufficiently good work to prove to those interested the worthwhileness of our undertakings.

The foregoing discussion of the graduate and research work of the Institute reveals another reason for admitting only 160 men each year to the freshman class and giving to all members of the staff

some, but *not too much*, teaching. The Institute has no purely research professorships as have some institutions, for it believes that a professor's own usefulness and even his professional productivity is increased rather than decreased if he has a limited amount of teaching duty. It is an excellent counter-irritant for the research man's inevitble tendency to overspecialization, keeping him from drying up, broadening his interests, and keeping him a human being. The flow of young blood through any institution the Trustees regard as wellnigh essential to its continued vitality and productivity. These are at least some of the aims and purposes that have been behind the creation of the California Institute of Technology.